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An Interim Assessment of the Shoal Lake Fishery 1987



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Lake of the Woods Fisheries Assessment Unit
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ABSTRACT

Monitoring of the Shoal Lake fishery was continued in 1987. The size of the walleye spawning population at Waugh was estimated at 14,990, with the 1979 year class accounting for 67.2% of the walleye caught. The 1983 year class contributed 14.9% and several immature walleye of the 1984 and 1985 year classes were also caught. Brown bullhead and yellow perch continued to feed on available walleye eggs.

The 1979 walleye year class represented 60.7% of the total walleye catch in index gill nets with the 1983 year class contributing 25.0%. Few walleye from other year classes were caught in index nets.


A total of 114 young-of-the year (YOY) walleye were caught during seining, electrofishing and fall gill netting, indicating the successful production of a 1987 year class. Continued survival of this year class to age of spawning should help improve walleye stocks on Shoal Lake.

Commercial fishing and angling for species other than walleye was minimal on Shoal Lake during 1987.

TRAP NETTING

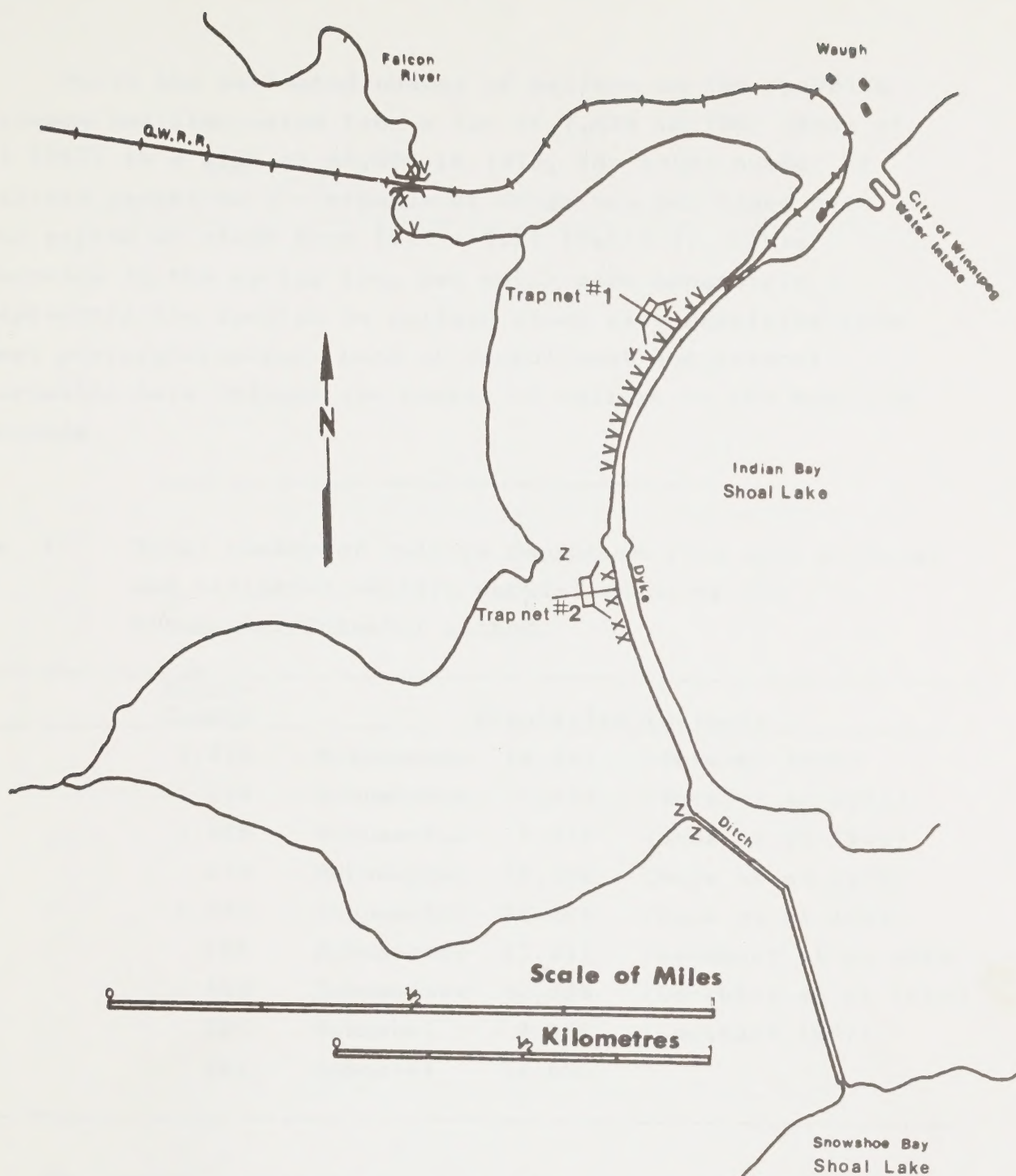
Two 1.2 m trap nets were fished at the Waugh spawning site near the mouth of the Falcon River from April 22 to May 4, 1987 (Figure 1). All captured walleye (Stizostedion vitreum) were measured for length/weight and their sex was determined by extrusion of gonadal products. A numbered yellow plastic disc tag was affixed in front of the spiny dorsal fin with monofilament line. Tag numbers were recorded from previously tagged walleye. Scales and the second dorsal spine were taken for ageing purposes. Northern pike (Esox lucius) were measured for length/weight and the right pelvic fin was clipped. Sex was determined by extrusion of gonadal products, and scale samples were taken for ageing purposes. All other species were counted and the right pelvic fin clipped before releasing the fish. Subsamples of yellow perch (Perca flavescens), brown bullhead (Ictalurus nebulosus), and common white sucker (Catostomus commersoni) were sampled for length/weight, sex, and stomach contents. Scales and dorsal spines from perch, scales and the marginal pelvic fin ray from suckers, and pectoral fin spines from bullheads were taken for ageing.

A total of 259 walleye were tagged in 1987. Three walleye carrying tags from the 1986 spawning run were caught, sampled and released. The 1987 walleye spawning population was estimated at 14,990, ranging from 4,049 to 25,381 at 95% confidence limits (Schnabel 1938). This estimate was slightly higher than the 1986 Schnabel estimate of 9,357 (Lockhart 1987). Bailey's triple catch method was used to compare the Schnabel estimate for the 1986 population and gave a population estimate of 7,443 ranging from 5,851 to 9,035 at 95% confidence limits (Bailey 1951). The Schnabel method likely overestimates population number and gives wide confidence limits due to the small number of tagged walleye being recaptured (Ricker 1975).



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- x - WALLEYE spawning sites improved in 1984 and 1985
- v - WALLEYE spawning sites improved in 1983
- y - locations of egg baskets, April - May 1987
- z - locations of fry traps, April - May 1987

Fig. 1. Map of Waugh spawning site, Shoal Lake, showing location of trap nets, egg baskets, fry traps and WALLEYE spawning bed improvement.

While the estimated number of walleye on the spawning grounds has fluctuated from a low of 7,434 in 1980 (Roos et al 1981) to a high of 46,296 in 1979, the total number of walleye caught on the grounds at Waugh has decreased over the period of study from 1979 - 1987 (Table 1). This decrease in the spring trap net catch more accurately represents the decline in walleye stock size resulting from past overexploitation. Lack of recruitment and natural mortality have reduced the number of walleye on the spawning grounds.

Table 1. Total number of walleye caught in trap nets at Waugh and estimated walleye population using the Schumacher/Schnabel method.

Year	Number Caught	Population Estimate		
1979	4,422	Schumacher	46,296	(Borecky 1980)
1980	716	Schumacher	7,434	(Roos et al 1981)
1981	1,025	Schumacher	7,675	(Roos et al 1982)
1982	872	Schumacher	13,139	(Roos et al 1983)
1983	1,387	Schumacher	25,804	(Roos et al 1984)
1984	665	Schumacher	32,311	(Lockhart et al 1985)
1985	468	Schumacher	30,886	(Lockhart et al 1986)
1986	203	Schnabel	9,357	(Lockhart 1987)
1987	262	Schnabel	14,990	

The ratio of male to female walleye on the spawning grounds in 1987 was 1.5 to 1 (143 males to 94 females), compared to 0.5:1 in 1986 (Lockhart 1987).

The 1979 year class accounted for 67.2% of all spawners (Fig. 2). The 1983 year class appeared moderately strong, contributing 14.9% to the sample. Several immature walleye of the 1984 and 1985 year classes were also caught in the trap nets, indicating some survival of these year classes.

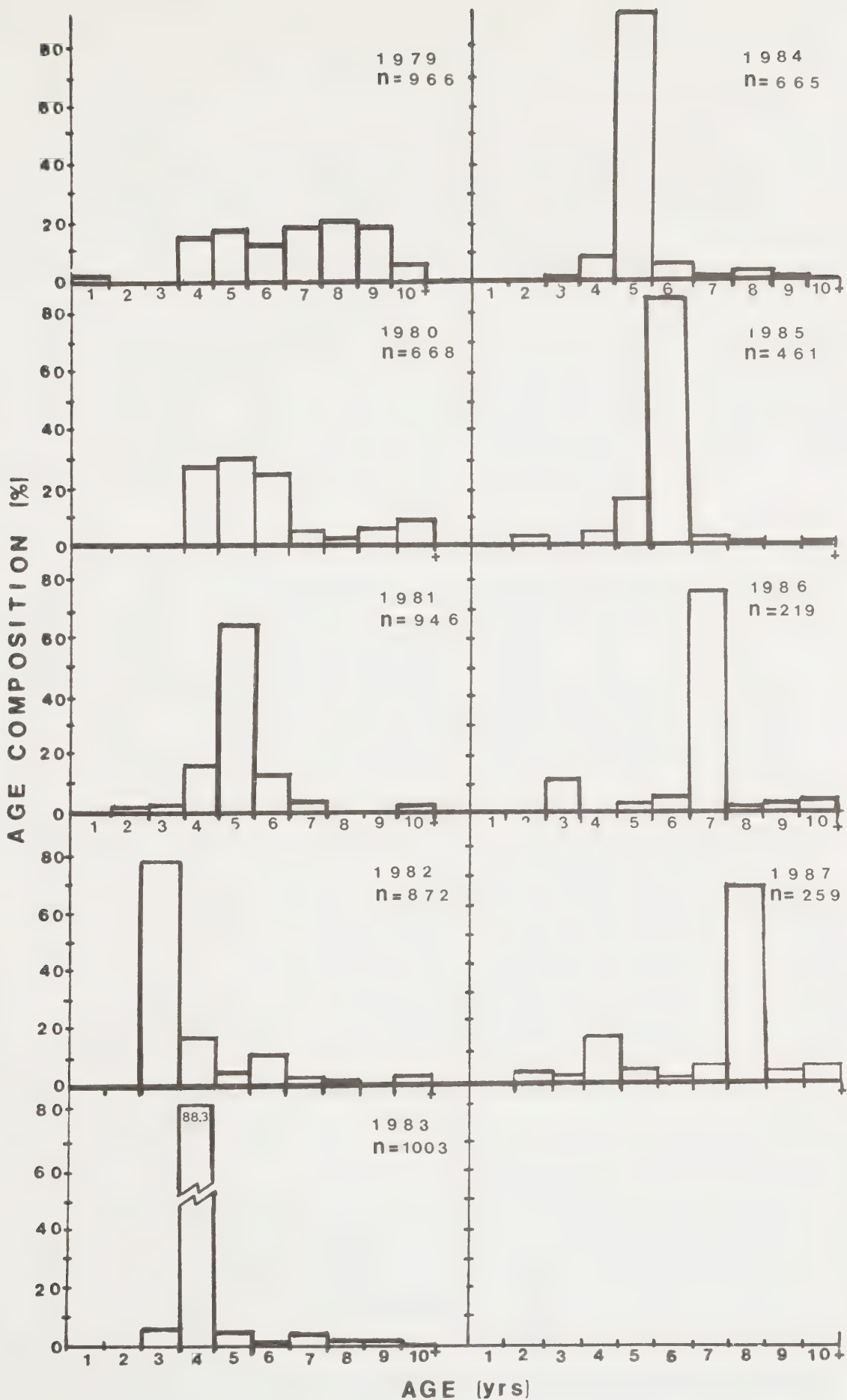


Fig. 2. Age composition (%) of WALLEYE caught in trap nets at the Waugh spawning site, Shoal Lake, during April and May, 1979 to 1987.

The 1980, 1981 and 1982 year classes represented 8.8 % of the total number of walleye caught. Some mature females of the 1983 year class and mature males of the 1985 year class should be present as first time spawners in 1988.

Weather conditions were very favourable for spawning in 1987. Water temperatures increased gradually during the run and spawning was completed uninterrupted. No sharp drops in temperature occurred during the period of hatching and dispersal of walleye fry.

A total of 101 northern pike were caught in the trap nets. The 1983, 1984 and 1985 year classes were about equally represented, contributing 76.3% to the total (Fig. 3). The oldest pike was aged at 7 years. The abundance of young pike of several year classes likely represents strong recruitment. A comparison of length-at-age for northern pike caught in trapnets at the Waugh site in 1979 (Borecky 1980, unpublished data), 1983 (Roos et al 1984, unpublished data) and 1987 showed an increase in length-at-age for both male and female pike (Figure 4). The reduced stock size of pike in Shoal Lake due to heavy exploitation prior to 1983 would have resulted in less competition and an increase in growth rate. Only half of the pike caught could be sexed externally, indicating that pike spawning was essentially completed by the start of the walleye run. Pike spawn in the shallows of Falcon Bay and in the Falcon River in mid April, while ice still covers the main part of Falcon Bay.

Stomach analysis of brown bullhead and yellow perch caught in trap nets on the spawning grounds at Waugh revealed their continued predation on walleye eggs. The percentage of bullheads feeding on walleye eggs increased to 75% of all fish sampled from 23% in 1986 (Table 2). The number of walleye eggs per bullhead sampled increased dramatically to 768 eggs/bullhead from 53 eggs/bullhead in 1986. Water levels in the spring of 1987 were the lowest encountered

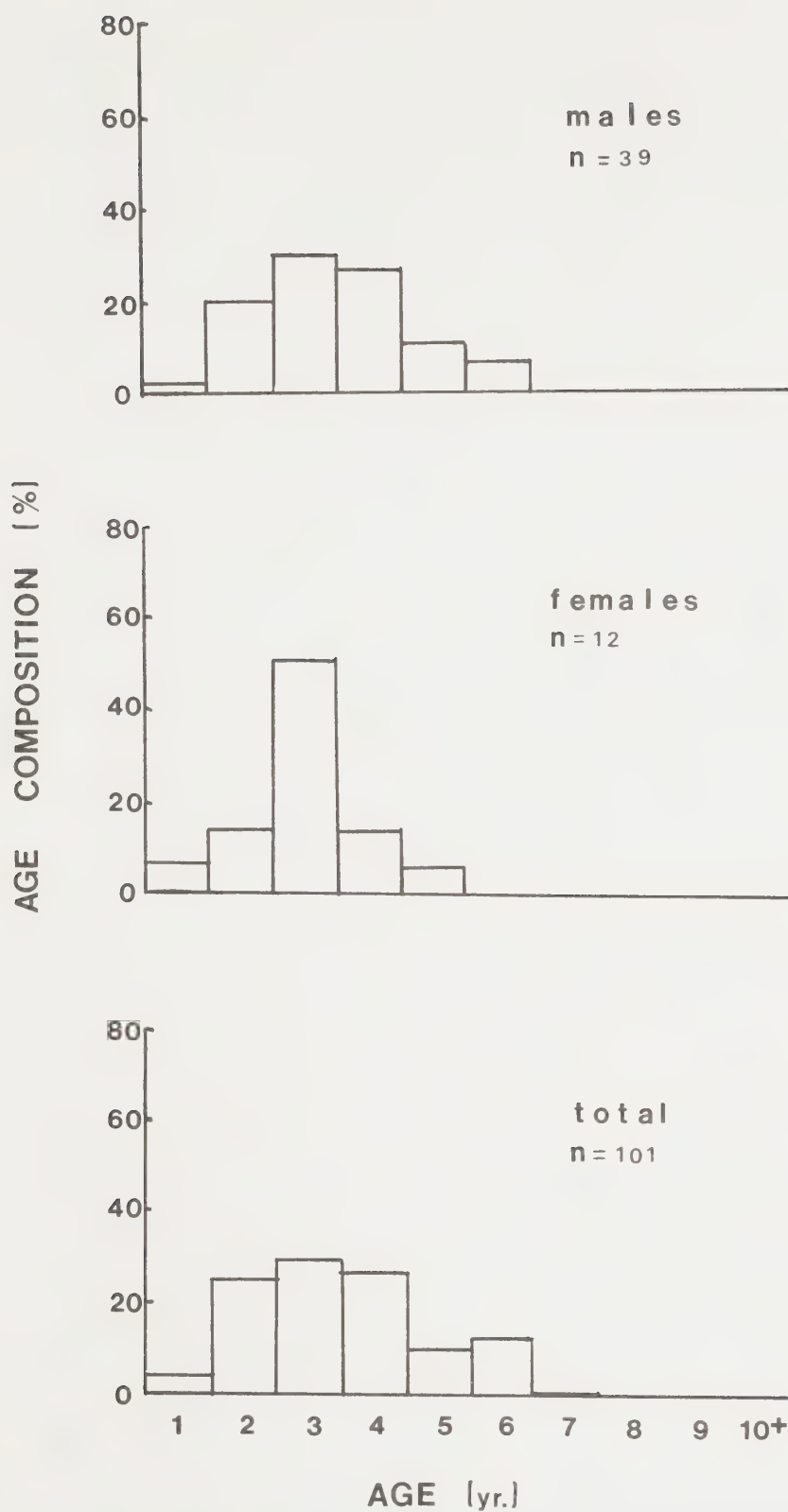


Fig. 3. Age composition (%) of NORTHERN PIKE caught in trap nets at the Waugh spawning site, Shoal Lake during April and May 1987.

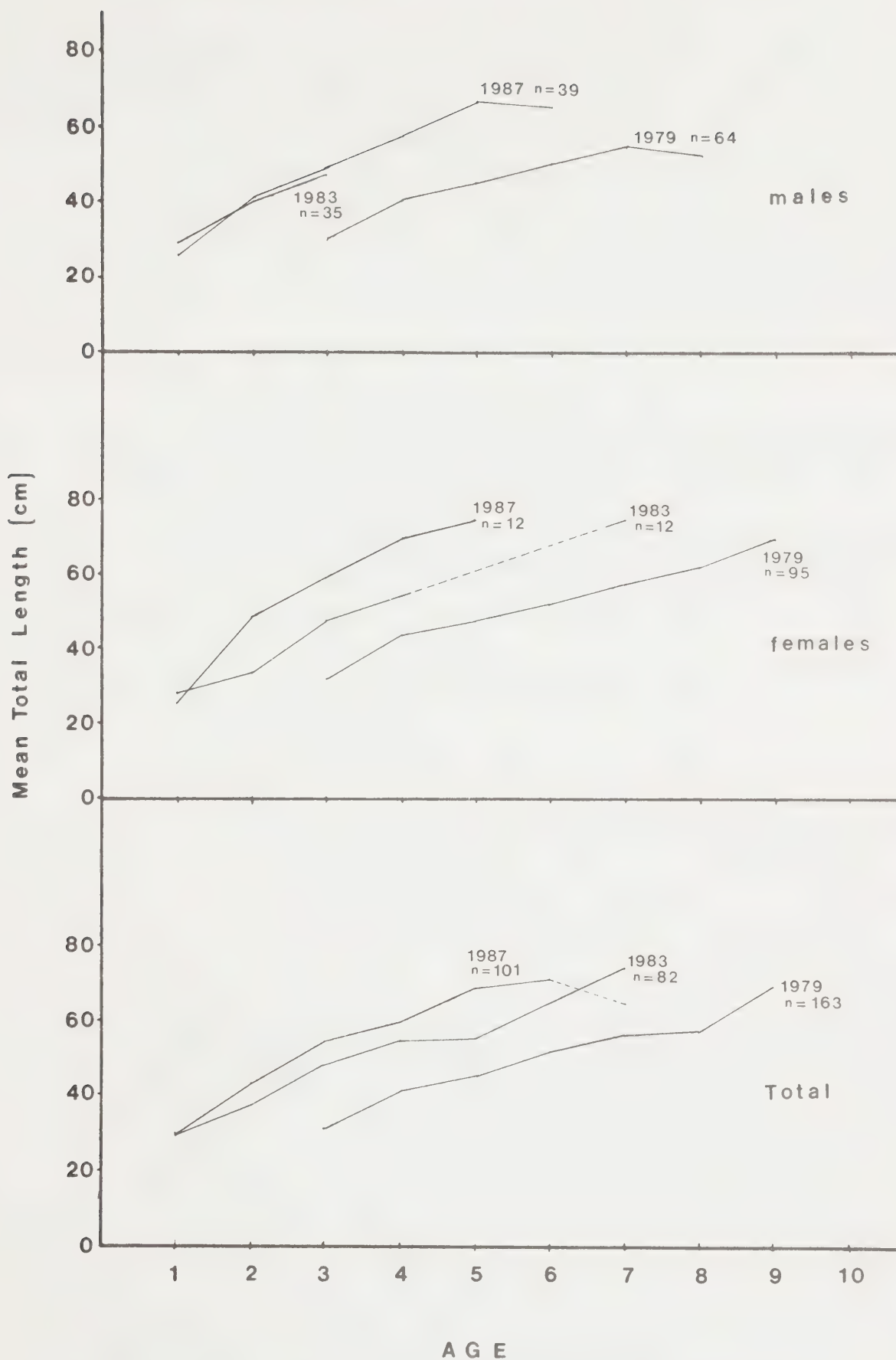


Fig. 4. A comparison of lengths at age for NORTHERN PIKE caught in trapnets at the Waugh spawning site in 1979, 1983 and 1987.

since spawning ground improvements were initiated in 1983 (Table 3). Much of the improved cobbled areas were left out of the water and walleyes were forced to spawn on less favourable substrate where eggs were more vulnerable to predation. Increased egg predation by yellow perch was also observed (Table 2). No eggs were found in any of the stomachs of white sucker that were examined.

Table 2. A comparison of stomach contents of brown bullhead and yellow perch caught in Waugh trap nets in 1984, 1985, 1986 and 1987.

	Bullhead				Perch			
	1984	1985	1986	1987	1984	1985	1986	1987
% with walleye eggs	60	51	23	.75	57	44	19	58
No. of walleye eggs/ fish with eggs	68	472	228	1028	29	48	26	127
No. eggs/fish sampled	41	132	53	768	17	21	5	74
No. fish sampled	78	61	65	87	28	39	47	43

Table 3. Shoal Lake water elevation in feet above sea level at the City of Winnipeg water intake station, Indian Bay as of May 1st each year (Glen Chambers, Greater Winnipeg Water Works Department; personal communication).

Year	1983	1984	1985	1986	1987
Elevation	1058.80	1058.43	1059.09	1060.08	1057.78

A baited minnow trap, set near the trap nets from April 22 to May 4, 1987, caught a total of 116 perch and one

mudminnow (Umbra limi). The perch ranged in size from 7.4 to 13.9 cm and were all ripe males. Seventy-three of the perch were sampled for stomach contents, of which thirty-six percent had consumed walleye eggs at the rate of 3 eggs per perch. Thirty-eight percent of the stomachs were empty and the remainder contained insect larvae or amphipods.

INDEX NETTING

Five standard index gill nets were set in May 1987 and ten standard index gill nets were set each month from June to August 1987, at sites used in previous years (Fig. 5). Nets consisted of eight separate panels (15.2m x 1.8m), ranging in mesh size from 3.8 to 12.7 cm (stretched mesh) in 1.3 cm increments. All walleye, northern pike, whitefish (Coregonus clupeaformis), smallmouth bass (Micropterus dolomieu), rock bass (Ambloplites rupestris) and burbot (Lota lota) were sampled for length/weight and ageing materials. Attempts were made to sample and release any walleye and pike found alive in the nets.

A mean catch-per-unit-effort of 1.7 walleye/lift was obtained in 35 lifts compared to 3.3 walleye/lift in 1986 (Lockhart 1987). The 1979 year class accounted for 60.7% of all walleye caught, followed by the 1983 year class at 25.0% (Fig. 6). Only one walleye from each of the 1981 and 1984 year classes were caught in index nets. No YOY walleye were caught during the standard index netting program from May through August 1987.

Mean lengths-at-age for walleye in 1987 were similar to those observed in 1985 and 1986 (Fig. 7). The accelerated growth of walleye, observed in past years appears to have levelled off.

Cisco (Coregonus artedii) formed the largest percentage (43.1%) of the total catch by number in index nets in 1987

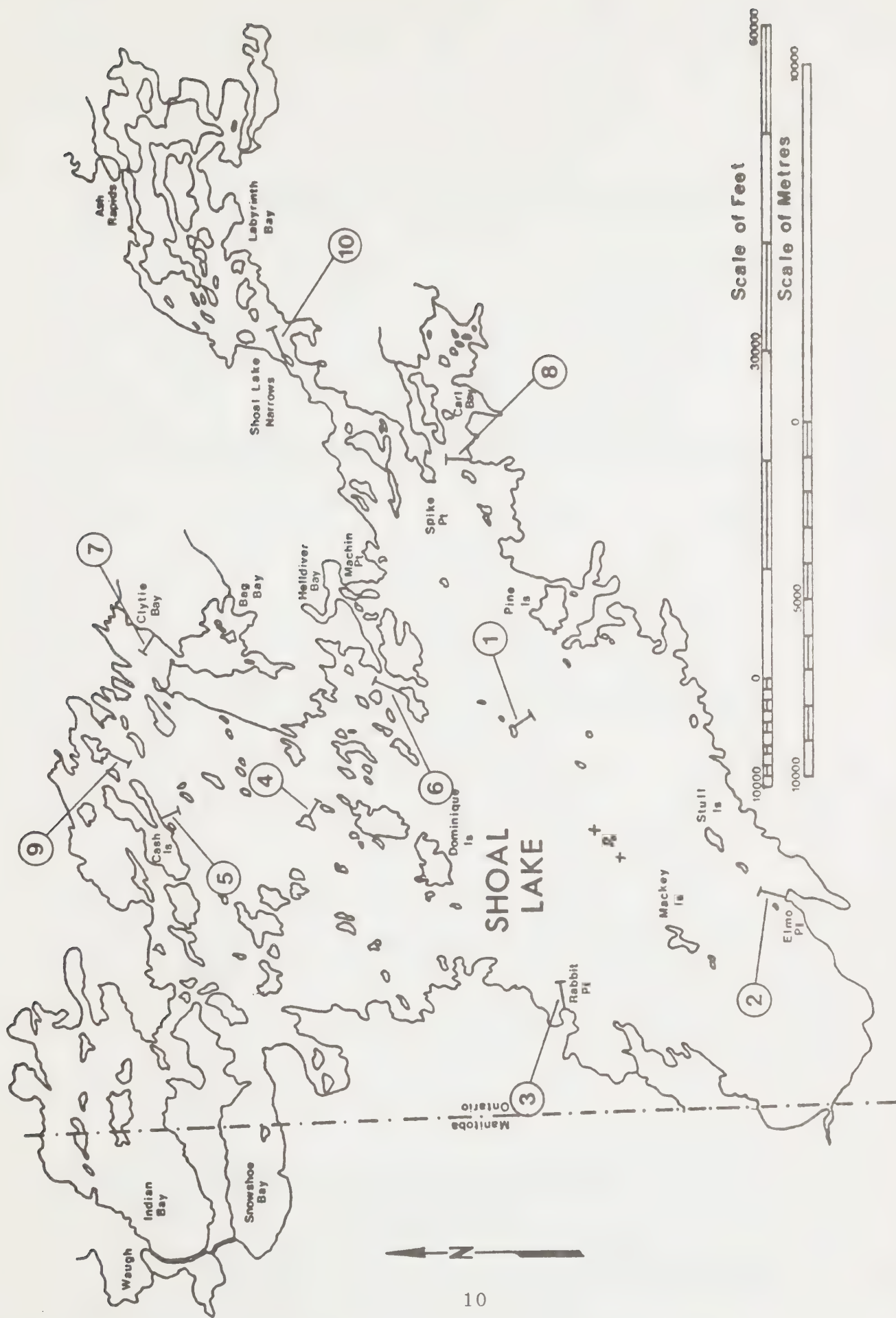


Fig. 5. Location of index gill net sites in Shoal Lake 1987.

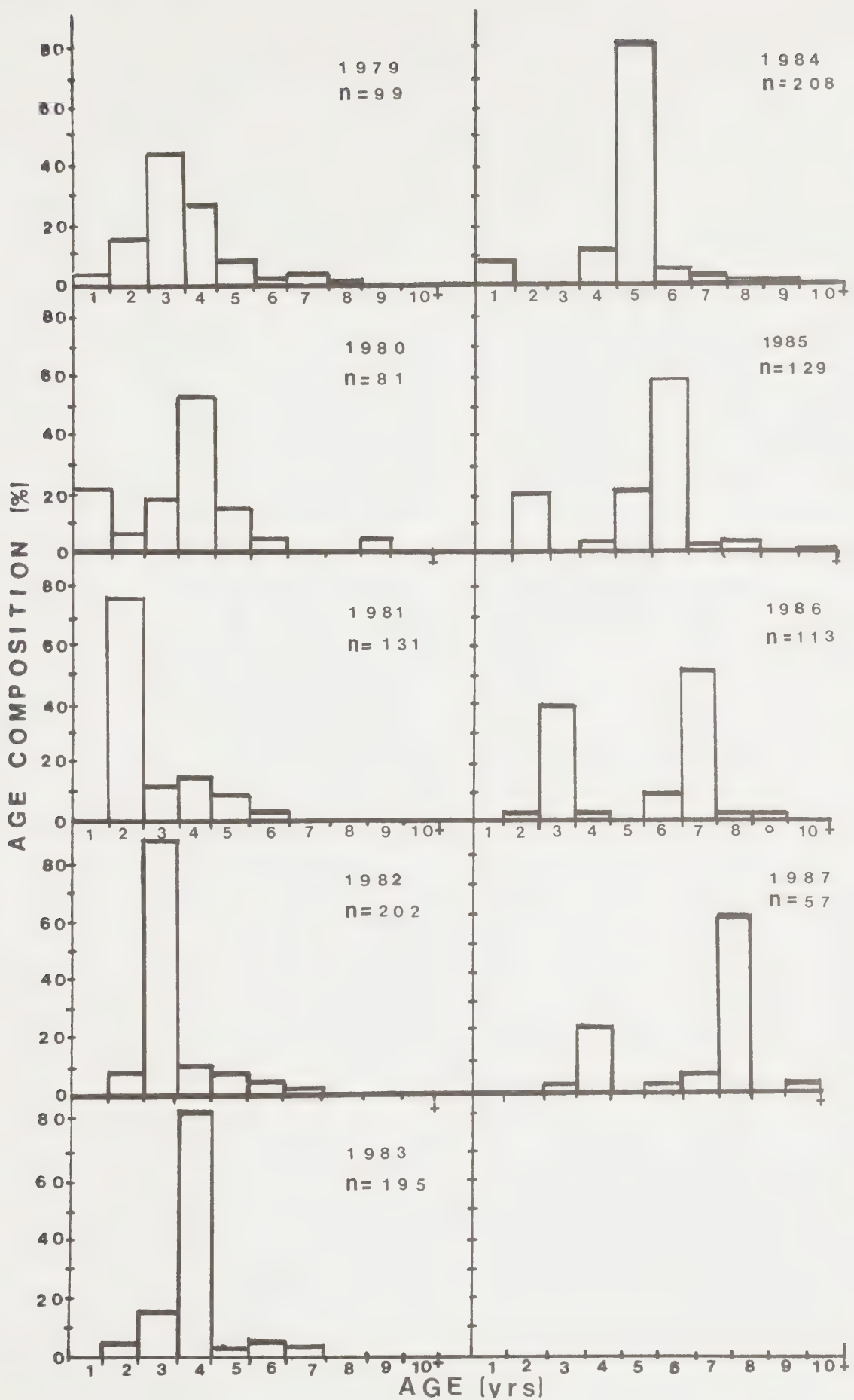


Fig. 6. Age composition (%) of WALLEYE caught in index gill nets in, Shoal Lake, 1979 to 1987.

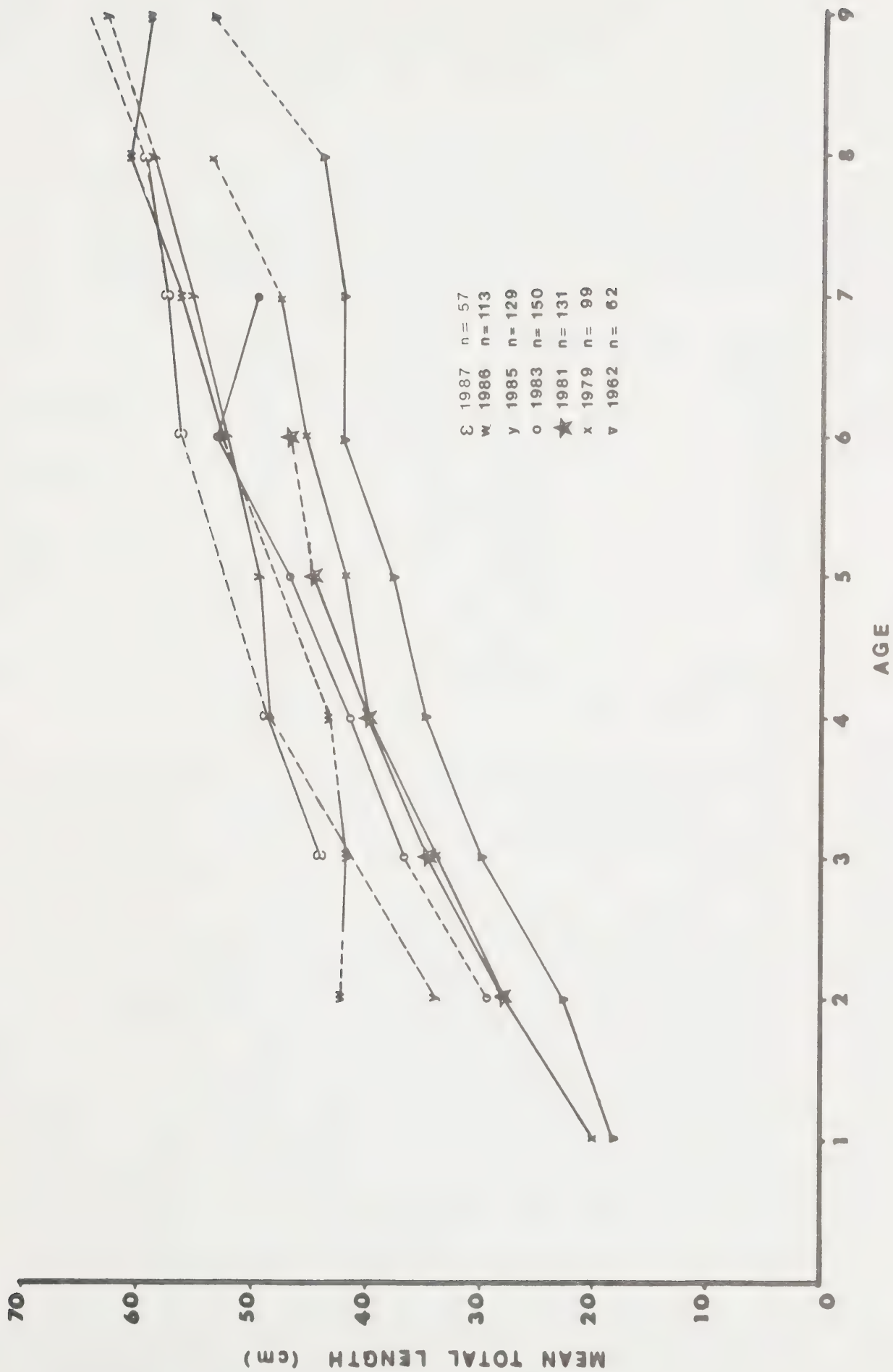


Fig. 7. Comparison of mean total lengths at age for WALLEYE caught in index gill nets during various years on Shoal Lake.

(Table 4). This was double the number caught in 1986 (21.7%) (Lockhart 1987). Yellow perch accounted for 39.8% of the total number of fish caught. This represented a decrease from 54.7% in 1986.

Table 4. Species composition expressed as percent composition by number, and catch-per-unit-effort (C.U.E.) by number and by weight from index gill nets set in Shoal Lake, during May to August 1987.

Species	Percent Composition by number	C.U.E. no./lift	C.U.E. kg/lift
Lake whitefish	0.9	0.8	0.8
Cisco	43.1	37.8	2.6
Northern pike	5.1	4.5	9.2
White sucker	5.8	5.1	3.1
Burbot	0.4	0.3	0.5
Rock bass	2.0	1.7	0.2
Smallmouth bass	0.8	0.7	0.6
Yellow perch	39.8	34.9	2.9
Walleye	1.9	1.7	3.0
Trout-perch	-	-	-
All species	99.8	87.5	22.9

Northern pike had a mean catch-per-unit-effort of 4.5 pike/lift. Ages were distributed over a range of year classes with six year olds accounting for 24.1% of the total pike catch (Fig. 8).

Length at age analysis (Fig. 9) for northern pike caught in index gill nets showed an increase in growth as compared to 1979 (Borecky 1980) and 1983 catches (Roos et al 1984, unpublished data). The accelerated growth which can be attributed to reduced competition among the existing pike stocks after the period of heavy exploitation prior to the ban on gill nets and closure of the walleye fishery in 1983.

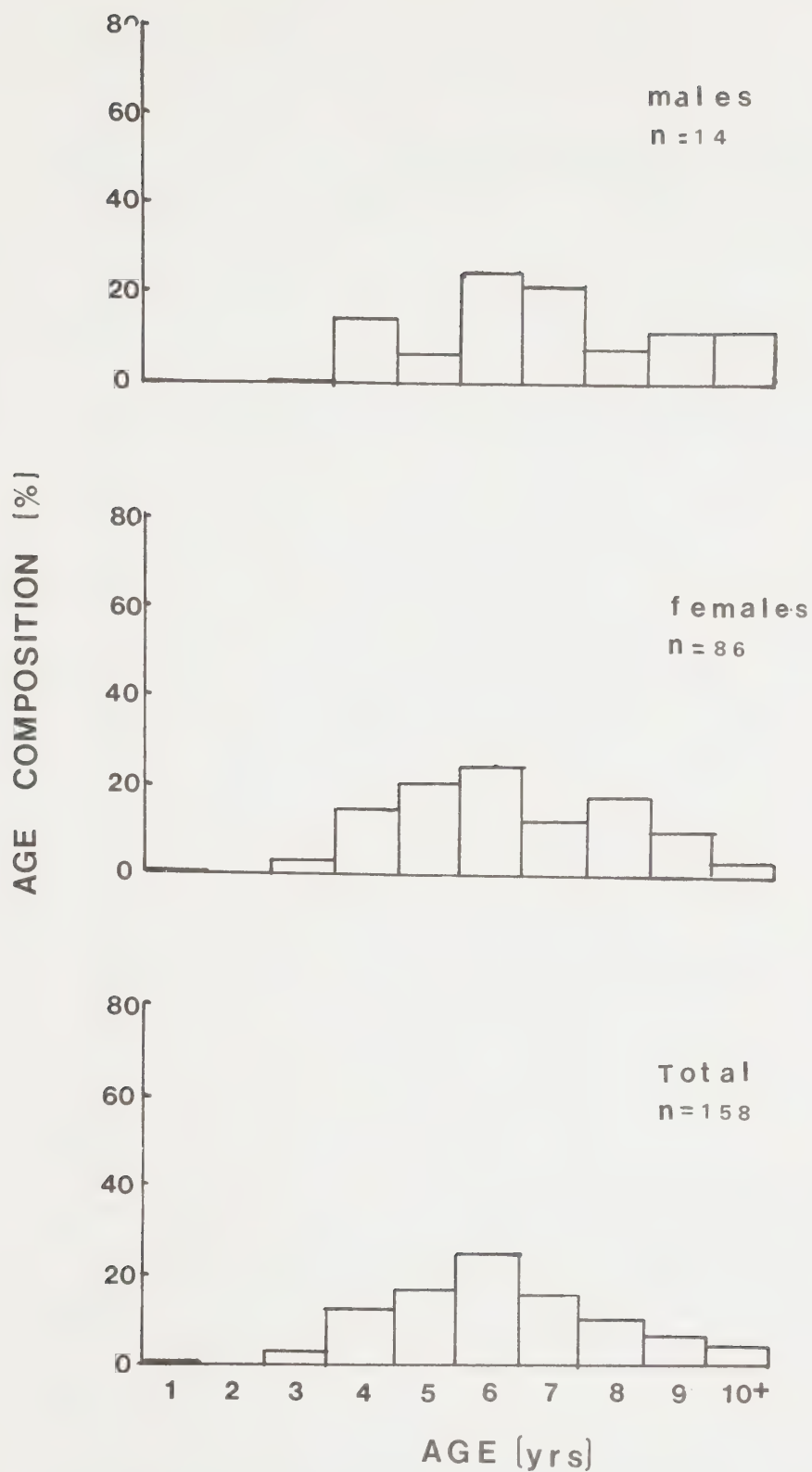


Fig. 8. Age composition (%) of NORTHERN PIKE caught in index gill nets in Shoal Lake, 1987.

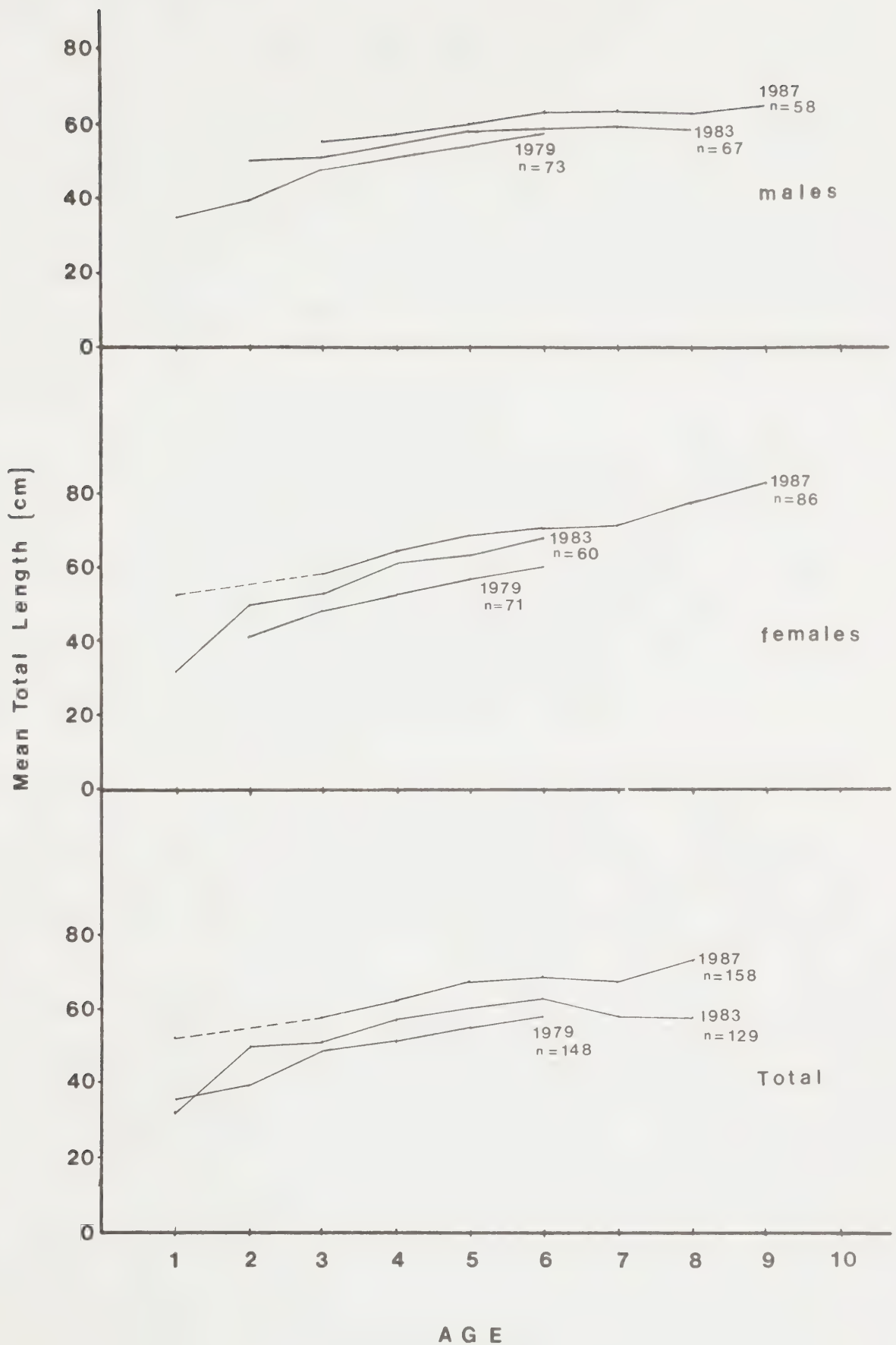


Fig. 9. A comparison of lengths-at-age for NORTHERN PIKE caught in index gill nets on Shoal Lake in 1979, 1983 and 1987.

SMALL FISH SAMPLING

A total of twenty-five seine hauls at ten index seine sites were made from June 29 to August 20, 1987, with a 30.8 m bag seine (Fig. 10). The Northwestern Region electrofishing boat was used on July 30, 1987, to sample areas poorly suited to seining. Seven experimental gill net sets were made in September for YOY walleye, using a standard index gill net and a 46.3 m section of 3.8 cm and 5.0 cm mesh gill net.

A total of 103 YOY walleye were caught at 5 different sites with the seine. Mean total length of the YOY walleye caught in seines ranged from 6.0 cm on June 30 to 16.1 cm on August 20, 1987. The overall catch-per-unit-effort for all small fish from index seine sites was 554 fish/seine, which was slightly lower than the 1986 catch of 791 fish/seine (Table 5). The number of yellow perch caught in seines in 1987 (8,027 total) was down from 1986 (13,616 total).

Aside from yellow perch, the number of small fish caught per seine was higher in 1987 (234/seine) than in 1986 (140/seine). The decrease in YOY perch abundance may have reduced competition between YOY walleye and YOY perch and contributed to the success of the 1987 walleye year class.

Electrofishing produced two YOY walleye during 47 minutes of shocking time. These averaged 13.4 cm in length. Three sampling runs were completed over a variety of potential walleye nursery areas which had been previously sampled during 1983-86.

Nine YOY walleye were caught by experimental netting in September with a mean total length of 17.4 cm from 5 different sites.

The abundance of YOY walleye in index nets, seines and

Electrofishing Sites *

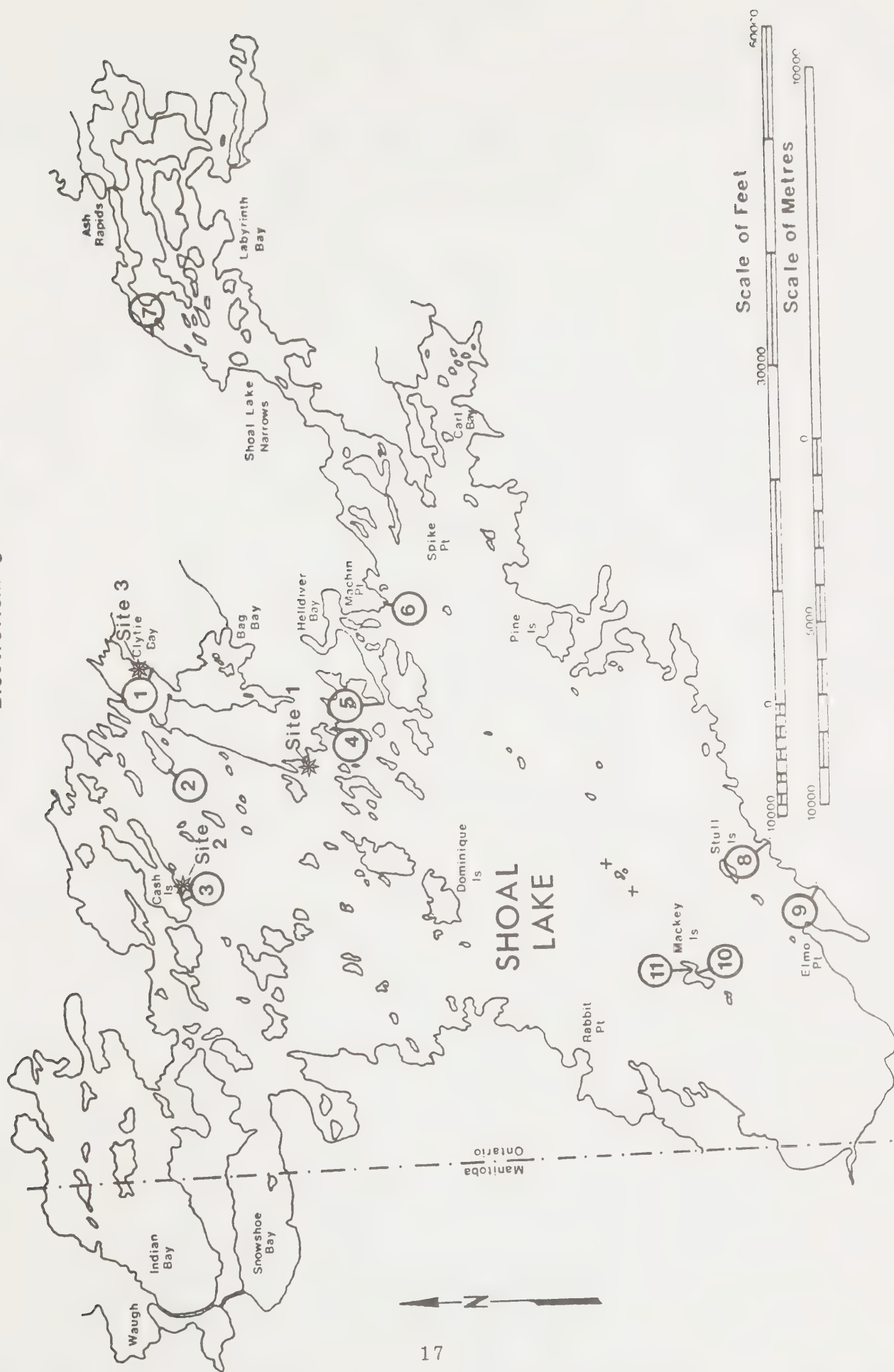


Fig. 10. Location of beach seine sites and electrofishing site on Shoal Lake, 1987.

Table 5. A comparison of seine net catches from Shoal Lake during 1983 to 1987, showing the total number of small fish and the percent of yellow perch caught.

Year	No. of seine hauls	<u>All species</u>		<u>All yellow perch</u>		<u>YOY yellow perch</u>		<u>Other species</u>	
		Total no.	No./seine	% total	No./seine	% total	No./seine	% total	No./seine
1983	21	15245	726	62%	453	*	*	38%	272
1984	22	27243	1238	69%	852	26%	317	31%	386
1985	22	49293	2241	92%	2050	89%	1994	8%	191
1986	21	16605	791	82%	651	73%	576	18%	140
1987	25	13839	554	58%	320	42%	233	42%	234

* no distinction made between YOY perch and older perch

electrofishing on Shoal Lake indicates that recruitment of walleye in 1987 was relatively good. Warm weather conditions experienced during the spring of 1987 allowed for a successful hatch of walleye eggs and continued survival through the fry stage.

It would appear that walleye which spawn on shoals and island sites on Shoal Lake are making a greater contribution to YOY year class formation. Many of the YOY walleye were caught in areas far removed from the Waugh spawning site and likely came from eggs laid on islands and shoals on the main body of Shoal Lake. The contribution of these shoal spawners may become increasingly more important in the future since the number of walleye returning to the Waugh site has been decreasing since 1979.

WALLEYE SPAWNING HABITAT ASSESSMENT

Potential walleye spawning sites were sampled with a fish egg collecting pan (Macins 1986). Eggs were identified to species and judged to be alive or dead according to criteria used in previous surveys (Roos et al 1981).

Surveys on April 21, 22 and 26, 1987, showed that walleye eggs were present along both sides of the dyke at Waugh, and upstream at the bridge on the Falcon River (Fig. 1). An average of 30 walleye eggs per sample were found in the river. Fifty-four eggs/sample were found on the Falcon Bay side of the dyke and 43 eggs/sample were found on the Shoal Lake side of the dyke. No white suckers eggs were found during these surveys.

Egg baskets (Martin 1957) were placed at two sites along the dyke on April 21, 1987 and lifted one to two weeks later. Three baskets were buried south of trap net # 1 (Fig. 1) and three were buried north of trap net # 1.

One tray from each site was lifted after 6 days. Approximately 5.1% of all walleye eggs present were alive. One more tray from each site was lifted after 10 days and 7.1% of the walleye eggs present were alive. Eyed eggs were observed at this time. The remaining two trays were lifted after 13 days on May 4, 1987. A survival rate of 2.7% was found for walleye eggs. Approximately 300 white sucker eggs were found in total, all of which were dead and covered with fungus.

Fry traps (Corbett 1980) which were placed in the canal leading from Falcon Bay into Shoal Lake yielded two walleye fry and several yellow perch fry. Walleye fry were captured with the fry traps for the first time in 1987.

COMMERCIAL FISH

The commercial fish harvest from Shoal Lake in 1987 was reported at 302 kg of northern pike and 1,571 kg of lake whitefish. Trap nets were used to catch fish prior to and during the fall whitefish spawning period.

SPORT FISHERY

A few parties angled for smallmouth bass, northern pike and muskellunge (Esox masquinongy) in Shoal Lake during 1987. A total of five parties were contacted by survey crews throughout the summer in the Shoal Lake Narrows and Clytie Bay areas. Only one pike was observed in the creel.

SUMMARY

The estimated size of the walleye spawning population at Waugh in 1987 was slightly higher at 14,990 than the 1986 estimate of 9,357. The 1979 year class contributed 67.2% to the total number of walleye sampled, with the 1983 year class contributing 14.9%. Some survival of the 1984 and 1985 year

classes was indicated by the capture of several immature 2 and 3 year old walleye on the spawning grounds. Weather conditions during and following the spawning run were favourable.

Stomach analysis of brown bullhead and yellow perch caught on the spawning grounds indicated a substantial increase in the number of walleye eggs consumed. This was due to low water levels which forced walleye to spawn in areas where the eggs were more vulnerable to predation. The number of walleye caught in index nets in 1987 dropped to 1.7 walleye/lift. The 1979 year class comprised 60.7% of all walleye caught, with the 1983 year class accounting for 25.0%. Few walleye from other year classes were caught in the index nets.

Northern pike caught in index nets exhibited a wide age class distribution and increased growth rate as compared to catches in 1979 and 1983.

A total of 114 YOY walleye were caught by seining, electrofishing and September gill netting. An apparently successful 1987 walleye year class can be attributed to the warm weather conditions in the spring and summer of 1987. The continued survival of this year class through to spawning age along with existing year classes of walleye should ensure continued natural reproduction and help to improve the status of the walleye stocks on Shoal Lake. The importance of favourable weather conditions during and following spawning was very evident in 1987. Successful spawning occurred even though water levels on the spawning grounds were low. The contribution of shoal spawners was likely another very important factor in the production of the 1987 walleye year class. The decreased abundance of YOY perch with a resultant decrease in competition with YOY walleye may also have contributed.

Angling pressure and commercial fish harvest was minimal on Shoal Lake in 1987.

Walleye stocks in Shoal Lake continue to show several gaps in the age class distribution. The indication of a relatively strong 1987 year class provides encouragement that Shoal Lake walleye may be able to recover successfully. Continued protection of the existing walleye stock is essential to ensure that adequate brood stock is available, and to allow young walleye to reach age of maturity. The continued closure on walleye fishing and ban on commercial gillnets will provide the best possible chance for the stocks to rebuild.

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